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MCDONNELL AIRCRAFT CORPORATION

Molybdenum Structural Component Program

Contract No.: NOw 61-0653-t
Task Order No.: 61-2

Progress Report
Covering Period

1 February 1963 to 1 May 1963

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1. Introduction. - This report covers the progress during the period between 1 February and 1 May 1963. The design and analysis of the final component control surface was completed during this period. No TZM molybdenum has been received to date.

2. Control Surface. - The control surface will be located at the wing trailing edge as shown in Figure 1. This final component, as shown in Figure 2, is composed of a combination truss-crimped web substructure covered with corrugated panels on the mold line surfaces. Attachment of the panels to the substructure is made at the corners by threaded attachments in oversize holes to allow for thermal expansion. The panels carry only air loads while the substructure provides capabilities for carrying shear, bending and torque loads. The hinge line is located along the forward rib so that a 20 degree movement can be attained either up or down, similar to conditions expected on a re-entry vehicle.

2.1 Design Conditions. - Using information from other McDonnell advanced research programs, the control surface was investigated for three critical flight conditions: boost, dive-in and glide.

Boost	Temperature - Below 1000°F	5.33 psi Collapse Pressure 4.91 psi Burst Pressure
Dive-in	Temperature - 1500°F	2.80 psi Collapse Pressure
Glide	Temperature - 3000°F	1.05 psi Collapse Pressure

2.2 Panels. - The panels (Figure 3) will be riveted skin-corrugation combinations. Since thin sheet (.020") is used for the lower panel skin and a smooth surface is required to simulate the actual flight conditions, dimples will be required to accept the flush head attachment rivets. The panels will bear on the caps of the inboard and outboard substructure ribs. Channels will be used on the edges of the lower panel normal to the corrugation with holes placed so that the powder or slurry used for coating can be implaced and removed.

The upper panel will deviate from the lower panel in detail design. Doublers will replace the edge channels and six one-inch diameter holes will be drilled through the panel for clearance of load rods during testing. Since the requirement for the load rod holes precluded the use of this panel as simulated flight hardware, it was decided to further simplify the panel fabrication by eliminating the dimples in the skin and using universal head rivets.

2.3 Substructure. - The basic substructure will contain channel and angle truss members and crimped webs riveted to angle caps. All members of this structure will be formed from TZM sheet except for the hinge fittings which will be Fansteel 82 columbium. Details of the substructure are shown in Figure 4.

Columbium was chosen for the fittings because this material can be readily welded and thereby permits a more efficient design. Temperatures of the fittings are such that columbium can be used efficiently.

It is planned to fabricate details and install fasteners during assembly by processes developed in previous phases of this program.

3. Milestone Chart. - The Milestone Chart (Figure 5) reflects completion or expected completion dates. The delivery dates for the TZM molybdenum material are not known so a schedule date can not be shown for this or the fabrication study which is dependent on material delivery. The schedule will slip the amount the material delivery slips and when the material is received the milestone chart will be revised. The completion of the design of the test components has been changed from scheduled completion the first of April to the first of July, since the delivery of TZM material has been postponed. This new date will still permit the design of the test elements to be complete before required.

TYPICAL FLIGHT VEHICLE

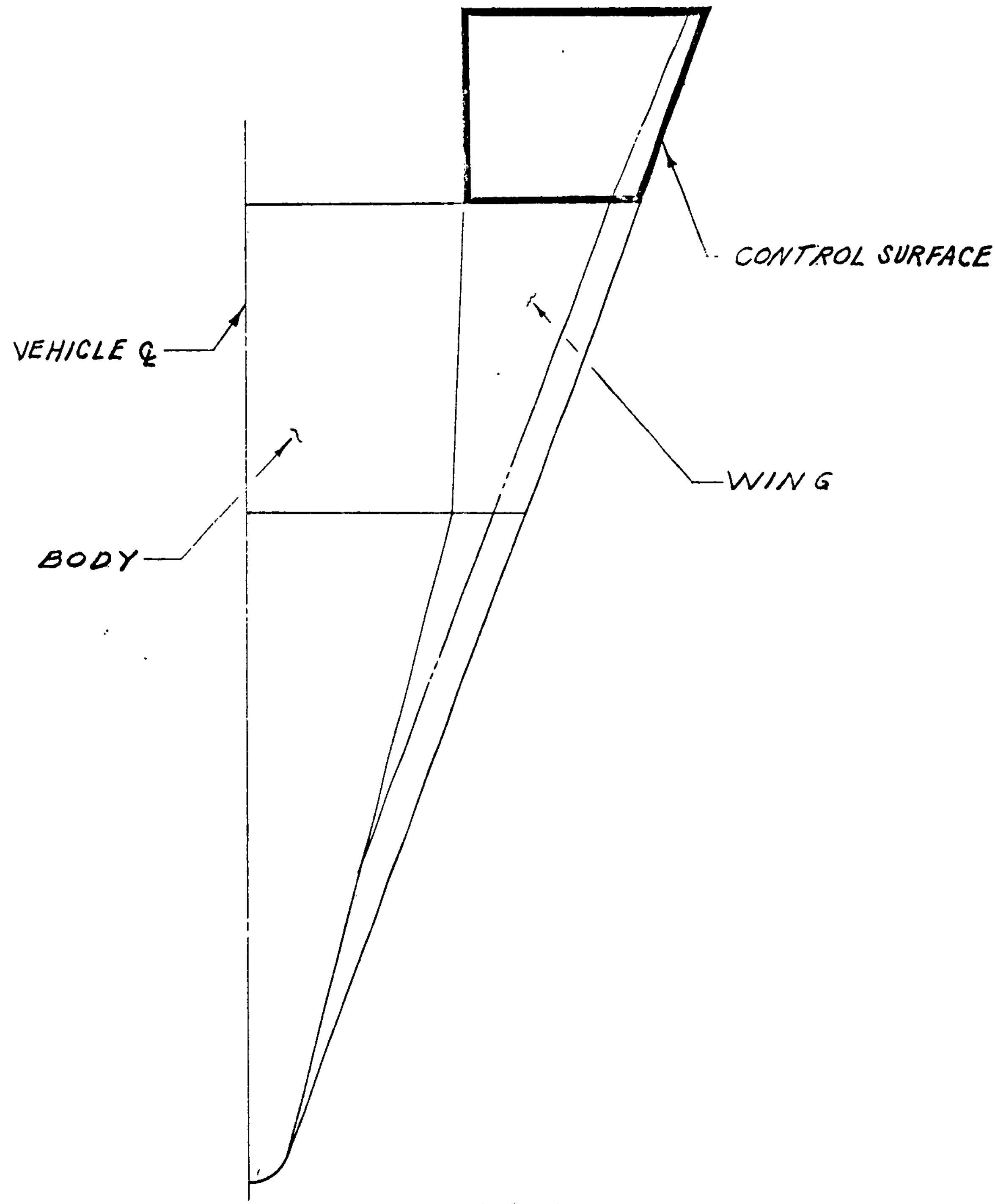


FIGURE 1

CONTROL SURFACE

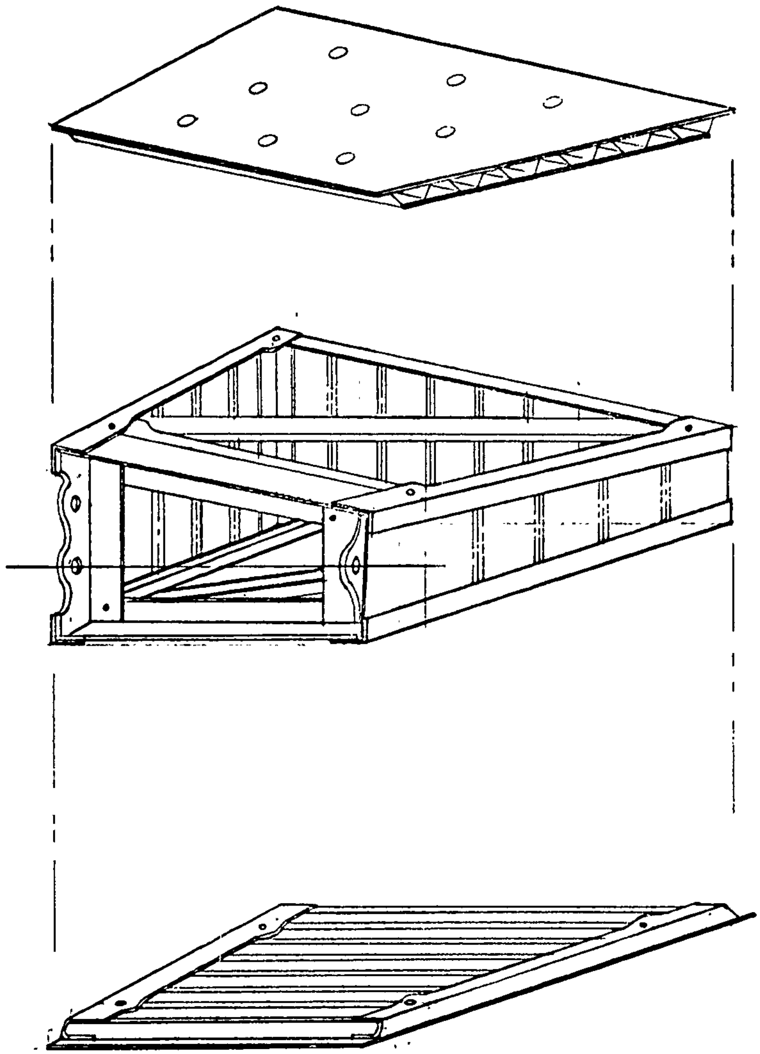
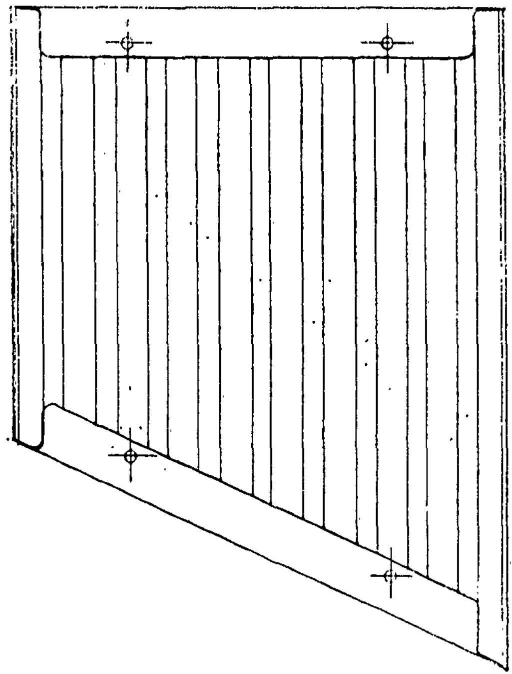
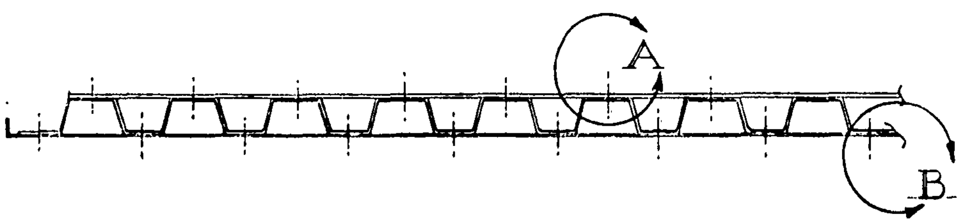


FIGURE 2

PANEL





MACHINE C'SINK

A

DIMPLE C'SINK

B

FIG. 3

SUBSTRUCTURE

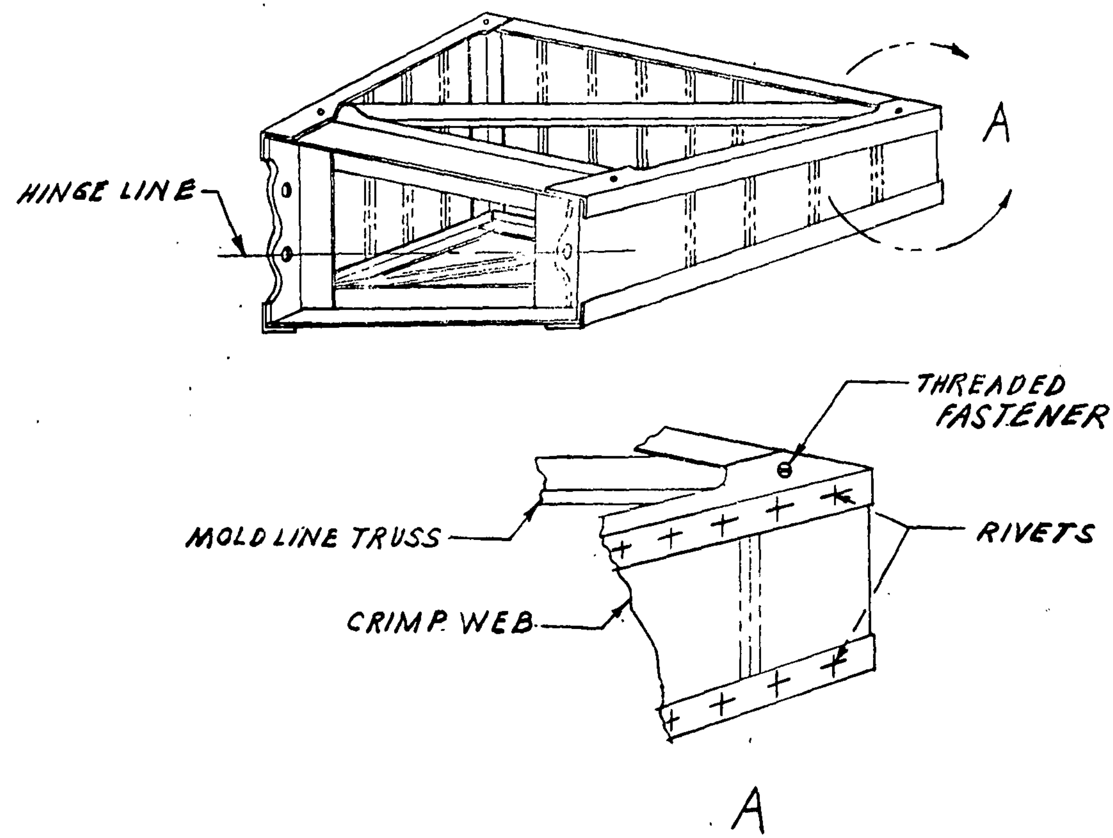


FIGURE 4

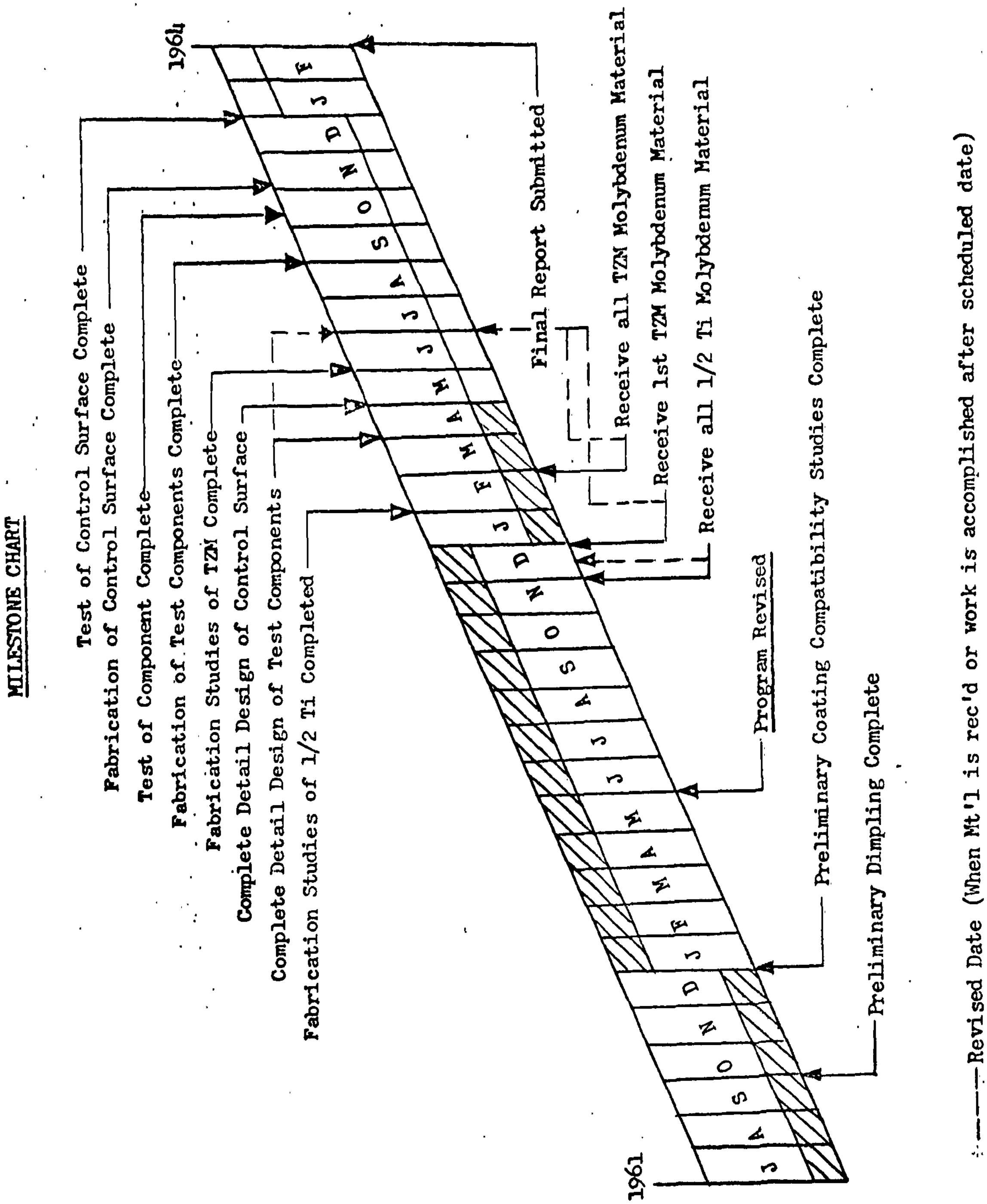

MILESTONE CHART
1961
1964
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F
Test of Control Surface Complete
Fabrication of Control Surface Complete
Test of Component Complete
Fabrication of Test Components Complete
Fabrication Studies of TZM Complete
Complete Detail Design of Control Surface
Complete Detail Design of Test Components
Fabrication Studies of 1/2 Ti Completed
Final Report Submitted
Receive all TZM Molybdenum Material
Receive 1st TZM Molybdenum Material
Receive all 1/2 Ti Molybdenum Material
Program Revised
Preliminary Coating Compatibility Studies Complete
Preliminary Dimpling Complete
Revised Date (When Mt'l is rec'd or work is accomplished after scheduled date)

FIGURE 5